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HOST PLANT RECORDS OF CERCOPIDAE IN NORTH AMERICA, NORTH OF MEXICO (HOMOPTERA)

KATHLEEN C. DOERING, Lawrence, Kansas

(Continued from the April issue)

*Clastoptera funesta Stal. *Gardenia Ellis (nymphs and adults, National Museum record).

Clastoptera globosa Fowl.

Clastoptera hyperici Gib. Hypericum prolificum L., Shrubby St. John's Wort (adults, McAtee).

Clastoptera juniperina Ball. Juniperus virginiana L., Red Cedar (adults, Ball); Solanum tuberosum L. (potatoes in Oregon).

Clastoptera laenata Fowl.

Clastoptera lawsoni Doer. Vitis sp., grapes (adults, Hubbard and Pierce).

Clastoptera lineatocollis Stal. Aplopappus acradensius (Fox); Artemisia dracunculoides Pursh., Linear-leaved Wormwood (Davis); Artemisia tridentata Nutt, Sagebrush (adults, Ball, Sweet); Chrysothamnus nauseosus var. speciosus Hall (Fox); Croton longipes Jones (Davis, Fox); Franseria dumosa Gray, Burro-Wood (Fox); Gutierrezia lucida Greene (Fox); Mentha sp. mint (adults, Ball); Senecio californicus DC (Sweet).

Clastoptera media Doer.

Clastoptera newporta Doer.

*Clastoptera obtusa var. borealis Ball.

Alnus sp. alder (Ball); Asimina triloba (L) Dunal, North American Papaw (Doer.); *Corylus rostrata Ait., Beaked Hazel-nut (nymphs, Ball); Juglans sp. Walnut (Doer); Quercus sp. oak (Doer.); Tilia americana L., Basswood, American Linden or White Wood (Ball); Vitis sp. (Ball).

*Clastoptera obtusa var. obtusa (Say). The Alder Spittle Bug. Aesculus L. Horse Chestnut (National Museum record); *Alnus rugosa Spreng., Smooth Alder; *Alnus serrulata=Alnus rugosa (Ball, Garman, Lintner, Osborn); Asimina triloba (L) Dunal, North American Papaw (Doer); Azalea nudiflora L., Honeysuckle (Lintner); *Betula populifolia Ait. American White Birch (nymphs, Garman); *Betula lutea Michx., Yellow or Grey Birch (nymphs, Garman); *Carya (Hicoria), Hickory (nymphs, Garman); *Hamamelis virginiana L. Witch Hazel (nymphs, Garman); Juglans sp., walnut (Doer.); Juglans cinerea L., Butternut (Lintner); *Ostrya virginiana (Mill.) Wild. Hop hornbeam or Ironwood (nymphs reared, Readio); Pinus sp. Pine (adults in mountains of Colorado, Van Duzee); Quercus, Oak (Doer.); Salix sp.

Willow (Ball, Van Duzee); **Tilia americana** L., Basswood, American Linden (Ball, Lintner); **Vaccinum** sp. Blueberry (Van Duzee).

Clastoptera obtusa var. **tristis** Van Duz.
Alnus sp (Ball); **Alnus incana** (L) Willd. Speckled or Hoary alder (Brenen); **Tilia** sp., Linden (Arnold Arboretum, Morrison); **Vitis** sp. Grape (Ball).

Clastoptera osborni Gill. and Bak. **Pinus** sp. Pine (adults, Beamer).

Clastoptera ovata Doer.

Clastoptera pallidocephala Doer. **Prunus Persica** Batsch. Peach. (National Museum record).

*__Clastoptera proteus__ var. __nigricollis__ Fitch. The Blueberry Spittlebug or The Dogwood Spittle-bug. **Cornus alba** L. Dogwood (adults, Arnold Arboretum); **Cornus Amomum** Mill., Silkey Cornel or Kinnikinnik (Arnold Arboretum); **Cornus racemosa** Lam., Dogwood (Arnold Arboretum); **Cornus stolonifera** Michx. Red Osier Dogwood (adults, Van Duzee); ***Vaccinum** sp. Blueberry (eggs, nymphs, Garman, adults, Arnold Arboretum); **Oxycoccus macrocarpus**, Large or American Cranberry (Ait) Pers.

Clastoptera proteus var. **osceola** Ball. **Vaccinum** sp., Blueberry (Arnold Arboretum).

*__Clastoptera proteus__ var. __proteus__ Fitch. ***Cornus** sp., Dogwood (nymphs, Kansas); **Cornus candidissima** Marsh, Panicled Dogwood (adults, Fitch).

Clastoptera saint-cyri var. **anceps** McAtee. Low vegetation in Michigan (Hungerford); **Vaccinum** sp., Blueberry (Arnold Arboretum); **Arctostaphylos uva-ursi Spreng.**, Bearberry (adults, Beamer).

*__Clastoptera saint-cyri__ var. __saint-cyri__ Provancher. Low vegetation in Michigan (Hungerford); **Gaylussacia** H.B.K. (National Museum record); **Leucothoe** sp. Evergreen Shrub (Arnold Arboretum); ***Oxycoccus macrocarpus** (Ait.) Pers. Large or American cranberry (nymphs, reared, National Museum); **Vaccinum** sp., Blueberry (Arnold Arboretum, Beamer); **Vaccinum pennsylvanicum** Lam., Dwarf, Lowbush or Sugar Blueberry (Brenen).

Clastoptera salicis Doer. **Salix amygdaloides** Anders. Peach-leaved Willow (Snow Entomological collection); **Salix longifolia** Muhl., Sandbar Willow, River Bank Willow (same collection).

Clastoptera sierra Doer.

Clastoptera siskiyou Doer. Low bush in Arizona (Beamer).

***Clastoptera testacea** Fitch. **Pinus**, pine (nymphs, Lintner). **Pinus strobus** L. white pine (National Museum record); **Quercus** L. Oak (Natonal Museum record).

Clastoptera texana Doer. **Carya pecan** Engl and Graebn. Pecan (Nat. Mus. record).

Clastoptera tricincta Doer.

***Clastoptera xanthocephala** var. **unicolor** Fowl.

***Ambrosia elatior** L. Hogwood, Ragweed, Roman Wormwood, Wild Tansy (nymphs, Heidemann); **Pinus virginiana** Mill., Scrub Pine (winters among foliage, McAtee).

***Clastoptera xanthocephala** var. **xanthocephala** Germ. ***Ambrosia** sp. (nymphs, a favorite plant, Ball); **Ambrosia trifida** L. Horseweed (National Museum record); **Anthemis arvensis** L. Corn or Field Camomile (National Museum record); ***Helianthus** sp. Sunflower (nymphs another favorite plant, Ball); **Helenium tenuifolium** Nutt. Fine-leaved Sneeze weed (National Museum record); *Grass (nymphs, Ball); *Many shrubs (nymphs, Ball); *many trees (nymphs, Ball).

Clastoptera uniformia Doer. **Juglans nigra** L. Black Walnut (adults swept, Beamer).

Cleavers. See **Galium aparine** var. **vaillantii** L.

Clematis ligusticifolia Nutt. Western Virgin's Bower. See **Lepyronia quadrangularis** (Say).

Colutea L. Bladder-Senna. See **Philaenus leucophthalmus** L.

Compositae. See

Ambrosia sp.
Ambrosia elatior L.
Ambrosia trifida L.
Aplopappus acradensius
Artemisia dracunculoides Pursh.
Artemisia ludoviciana Nutt.
Artemisia tridentata Nutt.
Aster paniculatus Lam.
Aster salicifolius Lam.
Chrysanthemum sp.
Chrysopsis villosa (Pursh.) Nutt.
Chrysothamnus graveolans Greene.
Chrysothamnus nauseosus var. **speciosus** Hall.
Chrysothamnus viscidiflorus var. **puberulus** Jepon.
Cirsium altissimum (L) Spreng.
Erigeron ramosus (Walt.) B.S.P.
Eupatorium altissimum L.
Franseria dumosa Gray.
Gutierrezia lucida Greene.
Helianthus sp.
Helianthus grosse-serratus Martens.
Helianthus petiolaris Nutt.
Heliopsis scabra Dunal.

Hymenoclea salsola T. and G.
Leptilon canadense (L) Britton.
Leontodon taraxacum L. (Taracum officinale, Weber).
Ridan alternifolius (L) Britton.
Rudbeckia fulgida Ait.
Senecio californicus Greene.
Solidago sp.
Solidago altissima L.
Solidago rigida L.
Vernonia baldwinii Torr.

Cornaceae. See
Cornus sp.
Cornus alba L.
Cornus Amomum Mill.
Cornus baileyi Coult. and Evans.
Cornus candidissima March.
Cornus racemosa Lam.
Cornus stolonifera Michx.

Cone-flower (Brilliant). See **Rudbeckia fulgida** Ait.

Cone-flower (Orange). See **Rudbeckia fulgida** Ait.

Coral-berry. See **Symphoricarpos orbiculatus** Moench.

Corn (Indian). See **Zea Mays** L.

Cornel (Silky). See **Cornus Amomum** Mill.

Cornus sp. Dogwood sp. See **Clastoptera proteus** var. **proteus** Fitch.

Cornus alba L. Dogwood. See **Clastoptera proteus** var. **nigricollis** Fitch; **Philaenus leucophthalmus** L.

Cornus Amomum Mill. Silky Cornel, **Kinnikinnik**. See **Clastoptera proteus** var. **nigricollis** Fitch.

Cornus baileyi Coult. and Evans. Dogwood. See **Clastoptera proteus** var. **nigricollis** Fitch.

Cornus candidissima Marsh. Panicled Dogwood. See **Clastoptera proteus** var. **proteus** Fitch.

Cornus racemosus Lam. Dogwood. See **Clastoptera proteus** var. **nigricollis** Fitch.

Cornus stolonifera Michx. Red Osier Dogwood. See **Clastoptera proteus** var. **nigricollis** Fitch.

Corylus sp. Hazels. See
Clastoptera achatina Germ.
Lepyronia quadrangularis (Say).

Corylus rostrata Ait. Beaked Hazel-nut. See **Clastoptera obtusa** var. **borealis** Ball.

Cotoneaster Med. See **Philaenus leucophthalmus** L.

Cotton. See Gossypium.

Cottonwood (Narrow-leaved). See **Populus angustifolia** James.

Cow-Parsnip. See **Heracleum lanatum** Michx.

Cranberry. See **Oxycoccus macrocarpus** (Ait.) Pers.

Croton longipes Jones. See **Clastoptera lineatocollis** Stal.

Currant (Indian). See **Symphoricarpos orbiculatus** Moench.

Cyperaceae. See **Carex** sp.

Cytisus (Tourn.) L. Broom.

Dactylis glomerata L. Orchard Grass. See **Philaenus lineatus** (Linn.).

Dandelion. See **Leontodon taraxacum** L.

Dewberry. See **Rubus canadensis** L.

Diervilla Adans. See **Philaenus leucophthalmus** L.

Dirca palustris L. Leatherwood. See **Philaenus leucophthalmus** L.

Dogbane. See **Apocynum cannabinum** L.

Dog-bane (Velvet). See **Apocynum pubescens** R. Br.

Dogwood. See

Cornus sp.
Cornus alba L.
Cornus baileyi Coult. and Evans.
Cornus racemosus Lam.

Dogwood (Panicled). See **Cornus candidissima** March.

Dogwood (Red Osier). See **Cornus stolonifera** Michx.

Dogwood Spittle-bug. See **Clastoptera proteus** var. **nigricollis** Fitch.

Dragon-head. See **Prunella vulgaris** L.

Elder. See **Sambucus callicarpus** Greene.

Enkianthus Lour. sp. See **Philaenus leucophthalmus** L.

Elm (Moose). See **Ulmus fulva** Michx.

Elm (Red). See **Ulmus fulva** Michx.

Elm (Slippery). See **Ulmus fulva** Michx.

Ericaceae. See

Arctostaphylos uva-ursi Spreng.
Azalea nudiflora L.

Erigeron ramosus (Walt.) B.S.P. Daisy Fleabane. See **Clastoptera quadrangularis** (Say).

Euonymus L. Burning Bush. See **Philaenus leucophthalmus** L.

Eupatorium altissimum L. Tall Thoroughwort. See **Lepyronia quadrangularis** (Say).

Euphorbiaceae. See **Croton longipes** Jones.

Fagaceae. See **Quercus** sp.

Fern. See **Aphrophora saratogensis** (Fitch).

Fleabane (Canada). See **Leptilon canadense** (L) Britton.

Fleabane (Daisy). See **Erigeron ramosus** (Walt.) B.S.P.

Fontonea sp. See **Philaenus leucophthalmus** L.

Fragaria sp. Strawberry. See **Philaenus leucophthalmus** and varie-

ties (Federal Bureau of Entomology Records).

Franseria dumosa Gray. Burro-weed. See **Clastoptera lineatocollis** Stal.

Gardenia Ellis. See **Clastoptera funesta** Stal.

Galium aparine var. **vaillantii** L. Cleavers, Goose-grass. See **Lepyronia quadrangularis** (Say).

Gaylussacia H.B.K. Huckleberry. See **Clastoptera saint-cyri** Prov.

Genista L. See **Philaenus leucophthalmus** L.

Geraniaceae. See **Geranium** sp.

Geranium sp. See **Philaronia abjecta** (Uhl.).

Geum canadensis Jacq. White Avens. See **Lepyronia quadrangularis** (Say).

Geum strictum Ait. Yellow Avens. See **Lepyronia quadrangularis** (Say).

Giant Umbellifera. See **Heracleum lanatum** Michx.

Golden-rod sp. See **Solidago** sp.

Golden-rod (Double). See **Solidago altissima** L.

Golden-rod (Stiff-Leaved). See **Solidago rigida** L.

Golden-rod (Tall). See **Solidago altissima** L.

Goosefoot (White). See **Chenopodium album** L.

Gossypium L. See **Lepyronia angulifera** Uhl.

Gramineae. See

Andropogan furcatus Muhl.
Bromus secalinus L.
Dactylis glomerata L.
Panicum virgatum L.
Panicum wilcoxianum Vasey.
Phleum pratense L.
Poa pratensis L.
Setaria lutescens (Weigel) F. T. Hubb.
Triodia flava (L) Smyth
Triticum aestivum L.
Zea Mays L.

Grape. See **Vitis** sp.

Grass. See:

Aphrophora quadrinotata Say.
Clastoptera xanthocephala var. **xanthocephala** Germ.

Grass (Blue-joint). See **Andropogan furcatus** Muhl.

Grass (Forked Beard). See **Andropogan furcatus** Muhl.

Grass (Goose). See **Galium aparine** var. **vaillantii** L.

Grass (Herd's). See **Phleum pratense** L.

Grass (June). See **Poa pratensis** L.

Grass (Kentucky Bluegrass). See **Poa pratensis** L.

Grass (Orchard). See **Dactylis glomerata** L.
Grass (Pigeon). See **Setaria lutescens** (Weigel) F. T. Hubb.
Grass (Prairie). See **Lepyronia gibbosa** Uhl.
Grass (Purple-top). See **Triodia flava** (L) Smyth.
Grass (Red-top, tall). See **Triodia flava** (L) Smyth.
Grass (Turkey-foot). See **Andropogan furcatus** Muhl.
Grass (Yellow Bristle). See **Setaria lutescens** (Weigel) F. T. Hubb.
Grass (Yellow Foxtail). See **Setaria lutescens** (Weigel) F. T. Hubb.
Gutierrezia lucida Greene. See **Clastoptera lineatocollis** Stal.
Hamamelidaceae. See **Hamamelis virginiana** L.
Hamamelis virginiana L. See **Clastoptera obtusa** var. **obtusa** (Say).
Hazels. See **Corylus** L.
Hazel-nut (Beaked). **Corylus rostrata** Ait.
Heal-all. See **Prunella vulgaris** L.
Hedge-nettle. See **Stachys palustris** L.
Helianthemum Adans. See **Philaenus leucophthalmus** L.
Helenium tenifolium L. Fine-leaved sneeze-weed. See
Clastoptera xanthocephala var. **xanthocephala** Germ.
Helianthus sp. See
Clastoptera xanthocephala var. **xanthocephala** Germ.
Helianthus grosse-serratus Martens (Saw-tooth Sunflower). See
Lepyronia quadrangularis (Say).
Philaronia abjecta var. **abjecta** Uhler.
Philaronia abjecta var. **provana** Ball.
Helianthus petiolaris Nutt., Prairie Sunflower. See
Lepyronia quadrangularis (Say).
Heliopsis scabra Dunal. Rough Ox-eye. See
Lepyronia quadrangularis (Say).
Hemlock. See **Tsuga canadensis** Carr.
Hemp (Indian). See **Apocynum cannabinum** L.
Heracleum lanatum Michx. See **Aphrophora angulata** Ball.
Hickory. See **Carya** sp.
Hickory (White Heart). See **Carya alba** Britton.
Hoarhound (Cut-leaved Water). See **Lycopus americanus** Muhl.
Hogwood. See **Ambrosia elatior** L.
Holly. See **Ilex opaca** Ait.
Honey-suckle. See **Azalea nudiflora** L. and **Lonicera** sp.
Hop Hornbeam (American). See **Ostrya virginiana** (Mill) Willd.
Horse Cane. See **Ambrosia trifida** L.
Horseweed. See
Ambrosia trifida L.
Leptilon canadense (L) Britton.
Huckle Berry. See **Gaylussacia** H.B.K.
Hypericae. See

Hypericum sp.
Hypericum prolificum L.
Triadenum virginicum (L) **Ref.**

Hypericum L. sp. See **Philaenus leucophthalmus** L.

Hypericum prolificum L. Shrubby St. John's Wort. See
Clastoptera hyperici Gib.

Hymenoclea salsola T. and G. See **Clastoptera brunnea** Ball.

Iberis L. See **Philaenus Leucophthalmus** L.

Ilex opaca Ait. See **Tomaspis bicincta** (Say).

Ironweed (Baldwin's). See **Vernonia baldwinii** Torr.

Ironweed (Yellow). See **Ridan alternifolius** (L) Britton.

Ironweed. See **Ostrya virginiana** (Mill.) Willd.

Juglandaceae See
Carya (Hicoria).
Carya alba Britton.
Juglans.
Juglans cinerea L.
Juglans nigra L.

Juglans. Walnut. See
Clastoptera obtusa var. **obtusa** (Say).
Clastoptera obtusa var. **borealis** Ball.

Juglans cinerea L. **Butternut.** See:
Clastoptera obtusa var. **obtusa** (Say).

Juglans nigra L. Black walnut. See
Clastoptera uniformia Doer.
Lepyronia quadrangularis (Say).

Juniper. California. See **Juniperus californica** Carr.

Juniperus sp. Cedar. See **Clastoptera elongata** Doer.

Juniperus californica Carr. (J. utahensis Lem). California Juniper.
See **Philaronia abjecta** Uhl.

Juniperus virginiana L. Red cedar. See
Clastoptera juniperina Ball.
Clastoptera arborina Ball.

Kerria DC . See **Philaenus leucophthalmus** L.

Kinnikinnik. See **Cornus Amomum** Mill.

Labiatae. See
Mentha sp. Mint.
Lycopus americanus Muhl.
Prunella vulgaris L.
Stachys palustris L.

Lactuca canadensis L. (Wild or Tall Lettuce). See
Lepyronia quadrangularis (Say).

Lactuca irrosa L. (Prickly or Wild Lettuce). See

Lepyronia quadrangularis (Say).

Lactuca pulchella (Pursh). DC. (Large Flowered Blue Lettuce). See **Lepyronia quadrangularis** (Say).

Lactuca spicata (Lam.) Hitchc. (Tall Blue Lettuce). See **Lepyronia quadrangularis** (Say).

Leatherwood. See **Dirca palustris** L.

Larch, American. See **Larix laricina** (DuRoi) Koch.

Larix laricina (Du Roi) Koch. American Larch, Tamarack. See **Aphrophora saratogensis** (Fitch).

Leguminosae. See

Lupinus sp.

Melilotus alba Desv.

Robinia pseudoacacia L.

Leontodon taraxacum L. Dandelion, Blowball. See **Lepyronia quadrangularis** (Say).

Leptilon canadense (L) Britton. Canada Fleabane, Horseweed. See **Lepyronia quadrangularis** (Say).

Lepyronia angulifera Uhl. Gossypium, cotton. (National Museum data).

Lepyronia angulifera var. **minuenda** Ball.

Lepyronia gibbosa Uhl. Prairie Grass (adults, Beamer); collected only in sandy areas (Ball).

***Lepyronia quadrangularis** (Say). *Nymphs found feeding on all of the following plants by Doering. Additional author references are given in parentheses.

Acer sp. Maples (Wirtner).

Agrimonia gyrposepala Wallr. Agrimony

Ambrosia artemisifolia. See **Ambrosia elatior** L.

Ambrosia trifida L. Horseweed, Horse-cane, Bitterweed, Great Ragweed.

Ambrosia elatior L. Hogwood, Roman Wormwood, Wild Tansy.

Andropogan furcatus Muhl. Forked Beardgrass, Blue-joint, Turkey foot.

Apocynum cannabinum L. Amy-root, Dogbane, Indian Hemp.

Apocynum pubescens R. Br. Velvet Dogbane.

Asclepias syriaca L. Common Milkweed.

Asclepias tuberosa L. Butterfly-weed or Pleurisy Root.

Asclepias verticillata L. Whorled Milkweed.

Aster paniculatus Lam. Tall white or Panicled Aster.

Aster salicifolius Lam. Willow Aster.

Bromus secalinus L. Chess or Cheat.

Carex sp. Sedge (Gill. and Bak.).

Chenopodium album L. Lam's Quarter, White Goosefoot, Pigweed.

Cirsium altissimum (L) Spreng. Tall or Roadside Thistle.

Clematis ligusticifolia Nutt. Western Virgin's Bower (also adults, Gill. and Bak.).

Cornus baileyi Coult. and Evans. Dogwood.

Corylus sp. Hazels (also Wirtner).

Leptilon canadense (L) Britton. Horse-weed, Canada Fleabane.

Erigeron ramosus (Walt.) B.S.P. Daisy Fleabane.

Eupatorium altissimum L. Tall Thoroughwort.

Galium aparine var. vaillantii L. Cleavers, Goose-Grass.

Geum canadense Jacq. White Avens.

Geum strictum Ait. Yellow Avens.

Helianthus grosse-serratus Martens. Saw-tooth Sunflower.

Helianthus petiolaris Nutt. Prairie Sunflower.

Heliopsis scabra Dunal. Rough Ox-eye.

Juglans nigra L. Black Walnut.

Lactuca canadensis L. Wild or Tall Lettuce.

Lactuca pulchella (Pursh) DC. Large Flowered Blue Lettuce.

Lactuca irrosa L. Prickly or Wild Lettuce.

Lactuca spicata (Lam.) Hitchc. Tall Blue Lettuce.

Lycopus americanus Muhl. Cut-leaved Water Hoarhound.

Melilotus alba Desv. White Melilot. Sweet White Clover.

Morus rubra L. Red Mulberry.

Washingtonia Claytoni (Michx.) Britton. Wooly Sweet Cicely.

Panicum virgatum L. Tall Smooth Panicum.

Panicum Wilcoxianum Vasey.

Phleum pratense L. Timothy or Herd's Grass.

Plantago Rugelii Done. Rugel's or Pale Plantain.

Prunella vulgaris L. Self-heal. Heal-all. Dragon-head.

Quercus virginiana Mill. Live Oak (National Museum data).

Rhus glabra L. Smooth Upland or Scarlet Sumac.

Ridan alternifolius (L) Britton. Wing stem or Yellow Ironweed.

Robinia pseudoacacia L. Locust-tree, False or Bastard Acacia, Silver-chain or Black Locust.

Rosa setigera Michx. Prairie Rose, Climbing Rose.

Rubus sp. Blackberry.

Rubus canadensis L. Low Running Blackberry, Dewberry.

Rubus occidentalis L. Black raspberry.

Rudbeckia fulgida Ait. Orange or Brilliant Coneflower.

Ruellia ciliosa Pursh. Hairy or Long-tube Ruellia.

Ruellia parviflora (Nees) Britton. Slender Hairy Ruellia.

Sambucus. Elder.

Sanicula canadensis L. Short-styled Snakeroot.

Sanicula marylandica L. Black Snakeroot.

Solidago altissima L. Tall, high or Double Golden-rod.

Solidago rigida L. Stiff or Hard-leafed Golden-rod.
Stachys palustris L. Hedge Nettle, Marsh or Clown's Woundwort.
Symphoricarpos orbiculatus Moench. Coral-berry. Indian Currant.
Leontodon taraxacum L. Dandelion or Blowball.
Triadenum virginicum (L) Ref. Marsh St. John's Wort.
Triodia flava (L) Smyth. Purple-top. Tall Red-top.
Triticum aestivum L. Wheat.
Ulmus fulva Michx. Slippery, Red or Moose Elm.
Urtica gracilis Ait. Slender Nettle.
Verbena urticifolia L. White or Nettle-leaved Vervain.
Vernonia baldwinii Torr. Baldwin's Iron-weed.
Zea Mays L. Maize, Indian Corn (Arkansas, Baerg).

Lettuce (Large Flowered Blue). See **Lactuca pulchella** (Pursh.) DC.
Lettuce (Prickly). See **Lactuca irrosa** L.
Lettuce (Tall). See **Lactuca canadensis** L.
Lettuce (Tall Blue). See **Lactuca spicata** (Lam.) Hitchc.
Lettuce (Wild). See
Lactuca canadensis L.
Lactuca irrosa L.
Ligustrum L. Privet. See **Philaenus leucophthalmus** L.
Linden. See **Tilia** sp.
Linden (American). See **Tilia Americana** L.
Locust (Chain). See **Robinia pseudoacacia** L.
Locust (Silver). See **Robinia pseudoacacia** L.
Locust-tree. See **Robinia pseudoacacia** L.
Lonicera L. Honey Suckle. See **Philaenus leucophthalmus** L.
Lupinus sp. See
Aphrophora permutata Uhl.
Philaronia abjecta (Uhl.).
Lycopus americana Muhl. Cut-leaved Water Hoarhound. See **Lepyronia quadrangularis** (Say).
Maize. See **Zea Mays** L.
Maple sp. See **Acer** sp.
Master-wort. See **Heracleum lanatum** Michx.
Meadow froghopper. See **Philaenus leucophthalmus** var. **leucophthalmus** (Linn.).
Medicago sativa L. See **Philaronia bilineata** (Say).
Melilot (White). See **Melilotus alba** Desv.
Melilotus alba Desv. White Melilot or Sweet White Clover. See **Lepyronia quadrangularis** (Say).
Mentha sp. See
Clastoptera binotata Ball.
Clastoptera lineatocollis Stal.

Milkweed (Common). See **Asclepias syriaca** L.

Milkweed (Whorled). See **Asclepias verticillata** L.

Mint. See **Mentha** sp.

Moraceae. See **Morus rubra** L.

Morus rubra L. Red Mulberry. See **Lepyronia quadrangularis** (Say).

Mugwort, Dark-Leaved. See **Artemisia ludoviciana** Nutt.

Mulberry (Red). See **Morus rubra** L.

Nettle (Slender). See **Urtica gracilis** Ait.

Oak. See **Quercus** sp.

Oak, Live. See **Quercus virginiana** Mill.

Ostrya Virginiana (Mill.) Willd. Hop Hornbeam or Iron-wood. See **Clastoptera obtusa** var. **obtusa** (Say).

Ox-eye (Rough). See **Heliopsis scabra** Dunal.

Oxycoccus macrocarpus (Ait) Pers. Large or American Cranberry. See **Clastoptera proteus** var. **nigricollis** Fitch.

Panicum (Tall Smooth). See **Panicum virgatum** L.

Panicum virgatum L. Tall Smooth Panicum. See **Lepyronia quadrangularis** (Say).

Panicum wilcoxianum Vasey. See **Lepyronia quadrangularis** (Say).

Papaw. See Asimina **triloba** (L) Dunal.

Peach. **Prunus persica** Batsch. See **Clastoptera pallidocephala** Doer.

Pecan. See **Carya pecan** Engl. and Graebn.

Phellodendron Rupr. See **Philaenus leucophthalmus** L.

Philaenus canadensis Walley.=**Philaronia abjecta** var. **provana** Ball.

Philaenus leucophthalmus L. (The following records are taken from National Museum records and include the color varieties):

Acer L .sp. Maple.

Aesculus parviflora Walt. Horse Chestnut, Buckeye.

Alyssum L.

Aronia Pero. Chokeberry.

Berberis L. Barberry.

Callicarpa L.

Colutea L. Bladder-Senna.

Cotoneaster Med.

Cornus alba L. Dogwood.

Cytisus (Tourn.) L. Broom.

Diervilla Adans. sp.

Dirca palustris L. Leatherwood.

Enkianthus Lour. sp.

Euonymus L. Burning Bush.

Fontonea sp.

Genista L.

Helianthemum Adans. Sun-Rose.

Hypericum L. sp. St. John's wort.

Iberis L. sp. Candytuft.
Kerria DC.
Ligustrum L. Privet.
Lonicera L. Honey Suckle.
Phellodendron Rupr.
Pinus L. sp. Pine.
Rosa L. sp. Rose.
Salix alba var. sericea Gand. White Willow.
Staphylea L. Bladdernut.
Tilia L. Linden.
Vaccinum L.
Philaenus leucophthalmus var. **fabricii** Van Duz.
Philaenus leucophthalmus var. **fasciatus** (Fabr.).
Philaenus leucophthalmus var. **lateralis** (Linn.).

Philaenus leucophthalmus var **leucocephalus** (Linn.).
The Meadow Froghopper. The Strawberry Spittle-bug. Strawberries (Federal Bureau of Entomology records).

*Philaenus leucophthalmus var. marginellus (Fabr.).
*Rosa polyantha Hort. Baby Rambler Rose in greenhouse (nymphs, Breakey).

*Philaenus leucophthalmus var. pallidus (Zett.). *Rosa polyantha Hort. Baby Rambler Rose in greenhouse (nymphs, Breakey).

*Philaenus leucophthalmus var. spumarius (Fall.).
*Rosa polyantha Hort. Baby Rambler in greenhouses (nymphs, Breakey). Setaria lutescens (Weigel) F. T. Hubb. Yellow Bristle Grass, Yellow Foxtail or Pigeon-grass (eggs laid in captivity, Barber and Ellis).

*Philaenus lineatus (Linn.).
Acer L. sp. Maple (National Museum record).
Dactylis glomerata L. Orchard grass (nymphs, Garman).
Grasses near extensive salt marshes (Barber and Ellis).
Phleum pratense L. Timothy, Herd's Grass (nymphs, Garman).
Poa pratensis L. Kentucky Blue-grass. June-grass.
Setaria lutescens (Weigel) F. T. Hubb. Yellow Bristle grass or Yellow Fox-tail, Pigeon-grass (eggs laid in captivity, Barber an Ellis).
Tilia L. Linden. (National Museum record).
Triodia flava (L) Smyth. Purple-top or Red-top (nymphs, Garman).
Common on all kinds of herbage (Edwards).

Philaenus parallelus Stearns. Carex sp. Sedge between clumps of cranberries (adults, Ball, Stearns).

*Philaronia abjecta (Uhl.).
Chrysothamnus viscidoflorus var. puberulus Jepson (adults, Dorst).

*Geranium sp. (nymphs on roots, Ball).
Helianthus grosse-serratus Martens. Saw-tooth Sunflower.
Juniperus utahensis Lem.=Juniperus californica Carr. California Juniper (National Museum record).
*Lupinus sp. Lupine (nymphs on roots, Ball).
Solidago sp. Goldenrod (adults, Brennen, Walley).
Salsola pestifer A. Nelson. Russian Thistle or cactus (National Museum record).

Philaronia abjecta var. provana Ball. Helianthus grosse-serratus Martens. Saw-tooth Sunflower (adults, Ball).

*Philaronia bilineata var. bilineata (Say). Setaria lutescens (Weigel) F. T. Hubb, Yellow Bristle Grass, Yellow Foxtail or Pigeon-grass (eggs laid in captivity, Barber and Ellis); Medicago sativa L. alfalfa (Wyo., Fox).

Philaronia bilineata var. nigricans Ball.

Philaronia bilineata var. orbiculata Ball.

Philaronia bilineata var. reticula Ball.

Phleum pratense L. See
Lepyronia quadrangularis (Say).
Philaenus lineatus (Linn).

Pigweed. See Chenopodium album L.

Pinaceae. See
Juniperus sp.
Juniperus virginiana L.
Larix laricina (Du Roi) Koch.
Pinus sp.
Pinus banksiana Lamb. Jack or Grey Northern Pine.
Pinus rigida Mill. Pitch Pine.
Pinus sabiniana Dougl. Digger Pine.
Pinus strobus L. White Pine or Weymouth Pine.
Pinus sylvestris L. Scots or Scotch Pine.
Pinus virginiana Mill.
Thuja occidentalis L.
Tsuga canadensis Carr.

Pine sp. See Pinus.
Pine (Digger). See Pinus sabiniana Dougl.
Pine (Grey or Northern Pine). See Pinus banksiana Lamb.
Pine (Jack). See Pinus banksiana Lamb.
Pine (Pitch). See Pinus rigida Mill.
Pine (Scrub). See Pinus virginiana Mill.
Pine (Scots or Scotch). See Pinus sylvestris L.
Pine (Weymouth). See Pinus strobus L.
Pine (White). See Pinus strobus L.
Pine Spittle Bug. See Aphrophora parallela (Say).

Pinus sp. Pine. See
Aphrophora annulata Ball.
Aphrophora irrorata Ball.
Aphrophora permutata Uhler.
Aphrophora signoreti Fitch.
Clastoptera obtusa var. **obtusa** (Say).
Clastoptera osborni Gill. & Bak.
Clastoptera testacea Fitch.
Philaenus leucophthalmus L.

Pinus banksiana Lamb. See
Aphrophora parallela (Say).
Aphrophora saratogensis (Fitch).

Pinus rigida Mill. See
Aphrophora parallela (Say).
Aphrophora saratogensis (Fitch).
Clastoptera testacea Fitch.

Pinus sabiniana Dougl. See **Aphrophora fulva** Doering.

Pinus strobus L. See
Aphrophora parallela (Say).
Aphrophora saratogensis (Fitch).

Pinus sylvestris L. See **Aphrophora parallela** (Say).

Pinus virginiana Mill. Scrub Pine. See
Clastoptera xanthocephala var. **unicolor** Fowl.

Plantain (Pale). See **Plantago Rugelii** Done.

Plantain (Rugel's). See **Plantago Rugelii** Done.

Plantaginaceae. See **Plantago Rugelii** Done.

Plantago Rugelii Done. Rugel's or Pale Plantain. See
Lepyronia quadrangularis (Say).

Pleurisy Root. See **Asclepias tuberosa** L.

Poa pratensis L. Kentucky Blue Grass. June-grass. See
Philaenus lineatus (Linn).

Populus angustifolia James. Narrow-leaved Cottonwood. See
Clastoptera elongata Doer.

Populus tremuloides Michx. See **Aphrophora irrorata** Ball.

Potato. See **Solanum tuberosum** L.

Privet. See **Ligustrum** L.

Prunella vulgaris L. Self-heal. Heal-all. Dragon-head. See
Lepyronia quadrangularis (Say).

Prunus Persica Batsch. Peach. See **Clastoptera pallidocephala** Doer.

Quercus sp. See
Clastoptera testacea Fitch.
Clastoptera obtusa var. **obtusa** (Say).
Clastoptera obtusa var. **borealis** Ball.

Quercus virginiana Mill. Live Oak. See **Lepyronia quadrangularis** (Say).

Rabbit-brush. See **Chrysothamnus graveolans** Greene.

Ragweed. See **Ambrosia elatior** L.

Ranunculaceae. **Clematis ligusticifolia** Nutt.

Raspberry (Black). See **Rubus occidentalis** L.

Rhus glabra L. Smooth Upland or Scarlet Sumac. See **Lepyronia quadrangularis** (Say).

Ridan alternifolius (L) Britton. Wing Stem, Yellow Ironweed. See **Lepyronia quadrangularis** (Say).

Robinia pseudoacacia L. Black Locust, Chain Locust, False Acacia, Locust-tree, Silver Locust. See **Lepyronia quadrangularis** (Say).

Rosaceae. See
Agrimonia gyrposepala Walbr.
Geum canadensis Jacq.
Geum strictum Ait.
Rosa L. sp.
Rosa polyantha Hort.
Rubus sp.
Rubus canadensis L.
Rubus occidentalis L.

Rose (Baby Rambler). See **Rosa polyantha** Hort.

Rosa L. sp. See **Philaenus leucophthalmus** L.

Rosa polyantha Hort. Baby Rambler Rose. See
Philaenus leucophthalmus var. marginellus (Fabr.).
Philaenus leucophthalmus var. pallidus (Zett.).
Philaenus leucophthalmus var. spumarius (Fall.).

Rubiaceae. See **Galium aparine var. vaillantii** L.

Rubus sp. Blackberry. See **Lepyronia quadrangularis** (Say).

Rubus canadensis L. Running Blackberry. Dewberry. See **Lepyronia quadrangularis** (Say).

Rubus occidentalis L. Black Raspberry. See **Lepyronia quadrangularis** (Say).

Rudbeckia fulgida Ait. Orange or Brilliant Cone-flower. See **Lepyronia quadrangularis** (Say).

Ruellia (Hairy). See **Ruellia ciliosa** Pursh.

Ruellia (Long-tube). See **Ruellia ciliosa** Pursh.

Ruellia (Slender Hairy). See **Ruellia parviflora** (Nees) Britton.

Ruellia ciliosa Pursh. Hairy or Long-tube Ruellia. See **Lepyronia quadrangularis** (Say).

Ruellia parviflora (Nees) Britton. Slender Hairy Ruellia. See **Lepyronia quadrangularis** (Say).

Sage. See **Artemisia ludoviciana** Nutt.

Sagebrush. See **Artemisia tridentata** Nutt.

Salicaceae. See
Populus angustifolia James.
Populus tremuloides Michx.
Salix sp.
Salix alba var **sericea** Gaud. White willow.
Salix amygdaloides Anders.
Salix longifolia Muhl.
Salix nigra Marsh. Black willow.
Salix petiolaris Smith. Slender Willow.

Salix sp. Willow. See
Aphrophora angulata Ball.
Aphrophora salicis De Geer.
Clastoptera obtusa var. **obtusa** (Say).

Salix alba var. sericea Gaud. See **Philaenus leucophthalmus** L.

Salix amygdaloides Anders. Peach-leaved Willow. See
Clastoptera salicis Doering.

Salix longifolia Muhl. Sand-bar or River-bank Willow. See
Clastoptera salicis Doer.

Salix nigra Marsh. See **Aphrophora salicis** De Geer.

Salix petiolaris Smith. See **Aphrophora salicis** De Geer.

Salsola pestifer A. Nels. See
Clastoptera delicata Uhl.
Philaronia abjecta (Uhl.).

Sanicula canadensis L. Short-styled Snake-root. See
Lepyronia quadrangularis (Say).

Sanicula Marylandica L. Black Snake-root. See
Lepyronia quadrangularis (Say).

Sambucus callicarpus Greene. See
Aphrophora permutata Uhl.
Lepyronia quadrangularis (Say).

Sedge sp. **Carex** sp.

Self-heal. See **Prunella vulgaris** L.

Senecio californicus DC. See **Clastoptera lineatocollis** Stal.

Setaria lutescens (Weigel) F. T. Hubb. Yellow Bristle Grass, Yellow Fox-tail, Pigeon Grass. See
Philaenus leucophthalmus var. **spumarius** (Fall).
Philaenus lineatus (Linn.).
Philaronia bilineata var. **bilineata** (Say).

Snake-root (Black). See **Sanicula Marylandica** L.

Snake-root (Short-styled). See **Sanicula canadensis** L.

Solanaceae. See **Solanum tuberosum** L.

Solanum tuberosum L. See **Clastoptera juniperina** Ball.

Solidago sp. Golden-rod. See **Philaronia abjecta** (Uhl.).

Solidago altissima L. Tall, High or Double Golden-rod. See

Lepyronia quadrangularis (Say).

Solidago rigida L. Stiff or Hard-leafed Golden-rod. See **Lepyronia quadrangularis** (Say).

St. John's Wort. See **Hypericum** L.

St. John's Wort (Marsh). See **Triadenum virginicum** (L) Ref.

St. John's Wort (Shrubby). See **Hypericum prolificum** L.

Stachys palustris L. Clown's Woundwort, Hedge-Nettle, Marsh.

Staphylea L. **Bladdernut.** See **Philaenus leucophthalmus** L.

Strawberry. See **Fragaria.**

Sumac (Scarlet). See **Rhus glabra** L.

Sumac (Smooth Upland). See **Rhus glabra** L.

Sunflower (Prairie). See **Helianthus petiolaris** Nutt.

Sunflower (Saw-tooth). See **Helianthus grosse-serratus** Martens.

Sun-Rose. See **Helianthemum** Adan.

Symphoricarpos orbiculatus Moench. Coral-berry, Indian Currant. See **Lepyronia quadrangularis** (Say).

Tamarack. See **Larix laricina** (Du Roi) Koch.

Tansy (Wild). See **Ambrosia elatior** L.

Thistle (Roadside). See **Cirsium altissimum** (L) Spreng.

Thistle (Tall). See **Cirsium altissimum** (L) Spreng.

Thistle (Russian). See **Salsola pestifer** A. Nelson.

Thoroughwort (Tall). See **Eupatorium altissimum** L.

Thuja occidentalis L. White Cedar or Arbor Vitae. See **Clastoptera arborina** Ball.

Tilia L. sp. Linden. See
Clastoptera achatina Germ.
Clastoptera obtusa var. **tristis** Van Duz.
Philaenus leucophthalmus L.
Philaenus lineatus L.

Tilia Americana L. American Linden, Basswood. See
Clastoptera obtusa var. **borealis** Ball.
Clastoptera obtusa var. **obtusa** (Say).

Tiliaceae. See
Tilia sp. Linden.
Tilia Americana L.

Timothy. See **Phleum pratense** L.

***Tomaspis bicincta** (Say).
*Lower stems and roots of grass clumps (nymphs, Ball); *sugar cane; and holly (adults).

Tomaspis bicincta var. **ignipecta** Fitch.

Triadenum virginicum (L) Ref. Marsh St. John's Wort. See **Lepyronia quadrangularis** (Say).

Triodia flava (L) Smyth. Purple-top. Tall Red-top. See **Lepyronia quadrangularis** (Say).

Philaenus lineatus (Linn).
Triticum aestivum L. Wheat. See **Lepyronia quadrangularis** (Say).
Tsuga canadensis Carr. See **Aphrophora parallela** (Say).
Ulmaceae. See **Ulmus fulva** Michx.
Ulmus fulva Michx. Slippery Elm, Red Elm, or Moose Elm. See
Lepyronia quadrangularis (Say).
Umbelliferae. See
Heracleum lanatum Michx.
Sanicula canadensis L.
Sanicula Marylandica L.
Washingtonia Claytoni (Michx.) Britton.
Urtica gracilis Ait. Slender Nettle. See
Lepyronia quadrangularis (Say).
Urticaceae. See **Urtica gracilis** Ait.
Vaccinaceae. See
Oxycoccus macrocarpus (Ait.) Pers.
Vaccinum sp.
Vaccinum pennsylvanicum Lam.
Vaccinum L. sp. Blueberry. See
Clastoptera obtusa var. **obtusa** (Say).
Clastoptera proteus var. **nigricollis** Fitch.
Clastoptera proteus var. **osceola** Ball.
Clastoptera saint-cyri var. **anceps** McAtee.
Clastoptera saint-cyri var. **saint-cyri** Provancher.
Philaenus leucophthalmus L.
Vaccinum pennsylvanicum Lam. Dwarf, Sugar or Lowbush Blueberry.
See **Clastoptera saint-cyri** var. **saint-cyri** Prov.
Verbena urticifolia L. White or Nettle-leaved Vervain. See
Lepyronia quadrangularis (Say).
Verbenaceae. See **Verbena urticifolia** L.
Vernonia baldwinii Torr. Baldwin's Ironweed. See
Aphrophora quadrinotata Say.
Lepyronia quadrangularis (Say).
Vervain (Nettle-leaved). See **Verbena urticifolia** L.
Vervain (White). See **Verbena urticifolia** L.
Virgin's Bower (Western). See **Clematis ligusticifolia** Nutt.
Vitaceae. See **Vitis** sp.
Vitis sp. Grape. See
Aphrophora signoreti Fitch.
Aphrophora quadrinotata Say.
Clastoptera lawsoni Doer.
Clastoptera obtusa var. **borealis** Ball.
Clastoptera obtusa var. **tristis** Van Duz.
Walnut. See **Juglans** sp.
Walnut (Black). See **Juglans nigra** L.

Washingtonia Claytoni (Michx.) Britton. See **Lepyronia quadrangularis** (Say).
Weeds. See **Aphrophora permutata** Uhler.
Wheat. See **triticum aestivum** L.
Willow. See **Salix** sp.
Willow (Black). See **Salix nigra** Marsh.
Willow (Peach-leaved). See **Salix amygdaloides** Anders.
Willow (River-bank). See **Salix longifolia** Muhl.
Willow (Sand-bar). See **Salix longifolia** Muhl.
Willow (Slender). See **Salix petiolaris** Smith.
Willow (White). See **Salix alba** var. **sericea** Gaud. White Willow.
Wingstem. See **Ridan alternifolius** (L) Britton.
Witch-Hazel. See **Hamamelis Virginiana** L.
Wormwood (Linear-leaved). See **Artemisia dracunloides** Pursh.
Wormwood (Roman). See **Ambrosia elatior** L.
Woundwort (Clown's). See **Stachys palustris** L.
Woundwort (Marsh). See **Stachys palustris** L.
Zea Mays L. Maize, Indian Corn. See **Lepyronia quadrangularis** (Say).

THE ALFALFA PLANT BUG (ADELPHOCORIS LINEOLATUS GEOZE) IN NEBRASKA (HEMIPTERA; MIRIDAE)

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The alfalfa plant bug (**Adelphocoris lineolatus** Geoze), first recorded in the middle west by Knight and since found in other midwestern states, has been present in Nebraska at least since June 10, 1936 when it was collected at lights at Omaha by the writer. Although a light trap project had been in progress at Lincoln from 1933 to 1938 there are no further records of this insect in the state until August 22, 1940 when it was swept from alfalfa in Lincoln by H. D. Tate.

On May 21, 1941 it was collected at lights in Lincoln by the writer and was numerous at lights throughout the summer. During 1941 the bug was found in both the adult and nymphal stages on alfalfa, potatoes, and beans, and two adults were collected on wheat. Except for a single adult taken at Osceola, Nebraska by D. B. Whelan, no other species have been collected in the state. Sweepings of a five acre alfalfa field on the college of agriculture campus were made throughout the summer of 1941 and a gradual build-up in population of the bug was observed until on September 9 a maximum of 37 adults and nymphs were collected in 100 sweeps. On October 4 only one bug could be found in 100 sweeps of the field.

Although this survey was of a limited area, the population that developed indicates that the bug might easily become an important pest of alfalfa in the middle west.

BIOLOGY OF THE SQUASH BLISTER BEETLE[1,2]

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The squash blister beetle was a pest of importance in gardens in northwestern Arkansas in the summer of 1939 and to a limited extent in 1940. Gardens surrounded by or bordering in meadow land or adjacent to open woods were more often injured than others in in 1939 outbreak. Most serious injury was observed in gardens adjacent to favored oviposition sites of the differential[3] and two-striped[4] grasshoppers.

The squash blister beetle is so named because it is the common blister beetle that attacks squash. Its range of hosts is wide and includes both wild as well as cultivated plants. Primarily the adult beetles are flower feeders and are attracted to several species of cucurbits, alfalfa, and a wild composite known as the western daisy.[5] All parts of flowers are destroyed, but the pollen is especially sought after. As accessory foods, fruits of squash and tomatoes may be chosen, and in 1939 considerable damage to these crops resulted. In one garden, late blossoms of squash and young fruits were completely destroyed, and older fruits were scarified on the surface disfiguring them and lowering their market value. On one occasion, several beetles were collected while they were feeding on the gills and lower sides of mushroom sporophores.

Range. This species may be found in the region east of the Rocky Mountains eastward to the Mississippi River from South Dakota southward to the Gulf of Mexico. In Arkansas, it is most common in the Ozark region in the northwestern part of the state. It has been found in the delta region of east central Arkansas where its hosts, both larval and adult, have been abundant for several years.

Description. This species may be readily recognized in the field as plump, dull black beetles with elytra reduced enough to expose two yellow subdorsal spots on the abdomen. These beetles are incapable of flight, but they may often go several hundred yards on foot at times. While these beetles vary greatly in size, they are larger than most local species as an average.

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[1] **Henous confertus** Say. (Meloidae, Coleoptera)

[2] Research Paper No. 728, Journal Series, University of Arkansas. Approved for publication by the Director of the Arkansas Agricultural Experiment Station.

[3] **Melanoplus differentialis** (Thos.)

[4] **M. bivittatus** Say.

[5] **Bellis integrifolia** Michx. Determined by D. M. Moore, Department of Botany, University of Arkansas.

The following is the original description by Say (3). "Body black, opaque, punctured; punctures crowded, concave, equally distributed, confluent, furnishing short black hairs; head with separated punctures on the anterior part of the front, distant ones on the clypeus, and remote ones on the labium: antennae regular: thorax as wide as the head, emarginate at base; sides very slightly arquated, hardly narrower at base; a longitudinal, dorsal, acute, impressed line: elytra scabrous, with minute elevated points, and numerous short black hairs. Length of male half, female four-fifths of an inch."

METHODS

Observations on which this paper is based were made during the interval between 1939 and 1941 at the Arkansas Agricultural Experiment Station, Fayetteville, Arkansas.

Rearing work was carried out in an incubator and in field cages which were designed to simulate natural conditions. Larvae were reared through their feeding period in individual glass tubes such as were used in rearing the back blister beetle (2). At the end of the feeding period, larvae were transferred to four-dram vials half filled with packed, moist soil.

Outdoor rearing chambers made of large glazed earthenware jars gave results comparable to natural conditions. Two cylindrical crocks, an outer one of a three-gallon size and an inner one of a two-gallon size provided the best combination. The inside one was suspended from the rim of the outer one by means of its shoulders, Vials and tubes containing larvae were placed on the bottom of the inner crock. These were covered by a circle of cellotex fitted snugly inside the inner crock as a preventive against sudden or great changes in temperature. A second check against outside air fluctuations was provided by a larger circle of cellotex fitted over the top of the crocks. The whole was made water tight by an over all covering of an inverted pot saucer of the twelve-inch size. A record of the temperature was kept by daily reading of a maximum-minimum thermometer inside the crock. Temperatures in such chambers were very similar most of the year to those recorded by a soil thermograph whose element was placed in the soil at a three-inch level.

LIFE HISTORY

Oviposition Habits. This species, like other common ones (1), lays its eggs at the bottom of narrow, tubular cavities. Firm soil preferably near some raised surface feature such as a clod, stick, stone, or bunch of grass is most often sought as an oviposition site.

The tube varies in diameter as the diameter of the individual beetle constructing it varies, and when complete, the walls may touch but not press against the beetle. Usually the bottom of the cavity is only an inch or less below the surface. The eggs are placed in a compact mass of more or less horizontal rows in the bottom of the cavity. Finally the cavity is plugged and sealed with soil as in the case of the black blister beetle(2).

The number of eggs in a mass may vary from 35 to 224 depending on the diet of the beetles. Those fed on a diet of leaves and fruit deposited masses having a mean 113 ± 3 eggs each, while those fed on a diet rich in pollen deposited masses having a mean of 164 ± 6 eggs each.

Egg Stage. An egg of this species is clearly different in size and general appearance from that of any species of Epicauta or Macrobasis that were observed. It is large by comparison, varying in length from 1.750 to 2.435 mm. with a mean length of 2.044 ± 0.010 mm. An individual egg is orange-yellow and is covered with a kind of reddish watery liquid which tends to collect in droplets. This liquid is sufficiently sticky to cause the eggs to remain in masses even when removed from the egg cavities. The combined color of the eggs and the liquid gives to a mass of eggs a reddish-orange cast.

The rate of egg development is directly influenced by temperature. Within normal range of conditions, eggs hatch in an interval of 16 to 26 days. In the laboratory, where the temperature was kept fairly constant about a mean of 80° F., 626 eggs required a mean of 16.8 ± 0.1 days for development. Under field conditions, where temperature fluctuations were greater and averaged six or eight degrees lower, 665 eggs required a mean of 24.1 ± 0.1 days for development. About 90 percent of the eggs under both sets of conditions hatched indicating that the range was within normal bounds.

LARVAL STAGE. The larvae are predacious on eggs of common species of grasshoppers especially those of the differential and two-striped grasshoppers. This fact is illustrated by field records of a high percentage of predatism on eggs of these two grasshoppers. At two different places in northwestern Arkansas in 1940 and 1941, as high as 23 per cent of the egg masses were wholly or almost wholly destroyed. The oviposition habits of these two grasshoppers made predatism easier by the fact that groups of egg pods are deposited, for the most part, in the matted roots of isolated clumps of bunch grass where the pods are often interlaced. Also, the pods are sometimes laid parallel to and near the surface

of the soil. Eggs of other species of grasshoppers that are deposited earlier than these must provide food for early larvae, for these larvae may seek food often weeks before eggs of the differential and two-striped grasshoppers are laid.

Seven larval instars represent the full course of development. The first five are the necessary feeding instars, and the last two do not feed and are supernumerary. The first five instars and the seventh are as active as other common forms of subsurface larvae. The sixth instar, also known at the coarctate, is incapable of motion of any sort, is encased in a tough, unyielding, reddish-brown cuticula, and all appendages including the mouthparts are atrophied.

Primary Larva. The description of the morphological details of the primary larva of the black blister beetle (2) applies in general to this species as well. It is much larger than the same instar of the black blister beetle and may be considered large in comparison with most common species. Its head width is 0.610 ± 0.015 mm. Larvae in this instar are reddish-brown with the dorsum of the prothorax and of abdominal segments 6, 7, and 8 darker brown.

Primary larvae remain one or more days in the egg cavity before they all burrow out and disperse over the surface of the soil and begin their search for grasshopper eggs. Most of those that are successful find food within the interval of ten days after dispersion. Under favorable conditions, some may live 20 days without food. During the peak of the hatching season in late August and early September, primary larvae of this species may be readily seen crawling about over the ground. Three primary larvae were seen at one time on an area of three square feet at one especially favored oviposition site.

Larvae seem to find grasshopper egg pods in a haphazard manner by drilling into the soil directly and by prying into cracks and under surface debris. The successful few that find egg pods enter them wherever they strike the pod. More often the entrance is along the side of the pod rather than through the froth cap. Oviposition habits of the differential grasshopper favor lateral entry becaues the egg pods are usually in a horizontal position.

Feeding begins as soon as eggs are found. At first a larva inserts its sickle-shaped mandibles causing the fluid contents of the eggs to exude into the closely appressed mouth of the larva. As the egg contracts, the larva expands correspondingly. Sometimes the contents of two eggs are required for the first meal. Larvae expand and become crescentic and incapable of much motion because of the pressure of imbibed egg contents. If the temperature is

optimum, a larva in this instar is replete within one or two days and may molt within two to seven days. Under less favorable fall temperature, feeding requires a much longer time.

Later Feeding Instars. Four feeding instars follow the first instar or primary larva. These are very similar in general appearance to those of the black blister beetle (2). All four are similar and progressively larger having head widths of 0.759 ± 0.022, 1.041 ± 0.010, 1.471 ± 0.012, and 1.950 ± 0.017 mm. for the second, third, fourth, and fifth instars respectively. Those reared under laboratory conditions followed one another in rapid succession with instars 2, 3, and 4 lasting one to three days each. Even the feeding part of the fifth instar was completed in two days. The remainder of the fifth instar was spent in part burrowing about in the soil and in part as a quiescent larva resembling a prepupa. Larvae reared in the laboratory require about 16 days from the time the eggs are supplied until all five feeding instars have been completed.

Under field conditions, many of those larvae that find suitable food in June or early July develop rapidly through the first five instars and upon molting the fifth time, pass into the pupal stage and become adults the same season. The remainder of these early ones pass into the coarctate form and remain dormant until the next year. All of those completing their feeding in August and early September likewise become coarctate larvae and overwinter as such. A third group that begins feeding late develops slowly through fall and early winter and usually winters as partially fed larvae in the fifth instar. These late ones become coarctate larvae in the spring. Coarctate larvae that pass the winter change to the seventh instar and pupate in the spring. Larvae that become coarctate in spring change to the seventh instar in late summer and pupate normally. Some of these may not molt until the year following if conditions are unfavorable.

Non-feeding Instars. Larvae in the coarctate form are very resistant to dessication, and under circumstances of extreme drought, this form provides the means for survival. Fortunately for the species coarctate larvae may survive two or even three years before further development need take place, but with each succeeding year, the percentage of survival decreases markedly. This stage is not necessary for winter survival in this latitude as larvae in the fifth instar pass winter without noticeable ill effect. That it is not an essential stage in development is shown by the fact that the instar may be omitted under some conditions. This form guarantees survival of the species but is not important in the development of the individual. In this respect, the development of this beetle is similar to that of the black blister beetle (2).

A return from the seventh instar to coarctate form has been

occasionally observed in laboratory rearing. Always the reversion occurs when a larva in the seventh instar is subjected to abnormally dry conditions. In such cases, the larva shrinks a bit in size and the second coarctate form is smaller than the first one. Regular development follows if favorable moisture conditions are maintained. When a reversion occurs nine instars (four of which do not feed) are required for completion of the larval stage.

Table I below shows the duration of the larval instars as observed in an incubator which was kept at a temperature of about 80° F.

Table I. Duration of larval stage at about 80° F.

Instar	Number of larvae	Duration in days		
		Maximum	Minimum	Mean
First	40	7	2	3.5 ± 0.2
Second	40	3	1	1.6 ± 0.1
Third	40	3	1	1.5 ± 0.1
Fourth	40	3	1	1.8 ± 0.1
Early fifth	40	2	2	2
Total feeding	40	13	8	10.5 ± 0.2
Late fifth	40	9	4	6.1 ± 0.2
Total 1-5 instars	40	19	14	16.5 ± 0.2
Sixth		Indefinite	Indefinite	
Seventh	20	24	11	15.6 ± 0.6

In the outdoor cages 36 to 38 eggs of the differential grasshopper were required for development, and the mean number consumed by 28 larvae was 37.3 ± 0.1 eggs. Since an egg pod of the differential grasshopper contains 100 or more eggs, two or three larvae may develop to maturity in a single egg mass at different times. Larvae will not feed peaceably together, but often two or more may feed at different places or at different times in the same egg pod. Frequently a part of the eggs is left uninjured.

PUPAL STAGE. Pupae are whitish when first formed and become progressively blacker beginning with a blackening of the eyes. They are always found in the soil in a nearly vertical position with the head upward. The stage is of short duration requiring about ten to 15 days for completion. It has never been found during the winter.

SEASONAL HISTORY

Adults begin to appear in late May and early June at the time of the flowering of the western daisy, and they may be collected from then until early October. These do not appear as broods, although they represent parts of two generations. Weekly records of sweeping in selected alfalfa fields show that adults were most abundant

during June and July in 1940 and 1941. This long period of adult abundance is accounted for by an extended period of emergence and not by excessive duration of adult life. In fact, adults live only four to six weeks.

The seasonal history is presented in Table II below.

Table II. Seasonal History

Month	Jan.	Feb.	Mar.	Apr.	May	June
Stage	5-6	5-6	5-6	67P	67PA	67PAE
Month	July	Aug.	Sept.	Oct.	Nov.	Dec.
Stage	67PAE1-5	PAE1-6	AE1-6	1-6	1-6	4-6

Note: Numbers 1-7 equal larval instars. P equals pupa. A equals adult. E equals egg.

Hibernating forms and active larval forms are found every month in the year in this latitude.

SUMMARY

The squash blister beetle was a pest of importance in gardens in northwestern Arkansas in the summer of 1939 and was one of less importance in 1940. Gardens surrounded by or bordering on meadow land adjacent to open woods were more often infested than those in other situations. In all localities where the differential and two-striped grasshoppers abounded, infestation reached serious proportions.

This blister beetle has been called the squash blister beetle because it is the most common species attacking fruits of squash varieties. Flowers of several species of cucurbits and those of alfalfa and the western daisy are preferred sources of food. Ripe tomato fruits are also injured by this species.

This may be considered a summer species because the adults occur all summer.

One and a partial second generation occur during outbreak years. Development may be rapid or delayed depending on whether feeding begins in summer or fall. True hibernation is not essential in this latitude. Quiescent (coarctate) larvae may be found every month in the year, and some may delay further development two or even three years. When the soil becomes abnormally dry after a larva has changed to the seventh instar, it may revert to the coarctate form until surrounding conditions are favorable for further development.

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SOME NEW AMERICAN RHOPALIDAE (HEMIPTERA)

H. M. HARRIS, Ames, Iowa

The following characterizations are presented at this time in order to make the names available for use in other manuscripts. The proportions are given in units, twenty-four of which equal one millimeter.

Stictopleurus knighti, sp. nov.

Size and form of **S. punctiventris (Dallas)**, the color generally more roseate than in that species.

Male: Head flat above, rugosely punctate, broader than long (38:30), the preocular portion with sides parallel to apex of antenniferous tubercule. Antennae moderately long, segment I swollen distally, projecting beyond apex of head by more than half its own length, II and III fairly stout, linear, IV one-half longer than distance between eyes (35:23); proportion of segments, 14:29:27:35. Bucculae not quite embracing basal half of first rostral segment. Rostrum just attaining apex of intermediate coxae, segment I not quite extending to base of head; proportion of segments, 19:18:14:15. Pronotum with punctures, impressions, and pubescence about as in **punctiventris (Dallas)**, the cicatrices forming complete loops laterally, the ridge anterior to them narrow and impunctate; sides slightly sinuate, the disc perhaps not so strongly raised posteriorly as in **punctiventris**; median length equal to three-fifths of width across humeri (30:50), the over all length equal to width of front lobe across cicatrices (35). Scutellum about as broad as long, strongly punctate, distinctly impressed or cupped on distal portion, the apex angular, its extreme tip sub-truncate. Hemelytra with base and exocorium coriaceous and punctate. Legs fairly stout, the femora speckled, the posterior ones black within except at base and apex. Metapleuron characteristic of the genus. Venter impressed each side of mid-line at base. Genital capsule more strongly produced at the mid-line beneath than in **punctiventris**, the parameres relatively flat, not conspicuously recurved and not bulbous at base as in that species. **Length:** 6.6-7.0 mm. **Width:** (pronotum) 2.08 mm.

Female: Proportionally larger than male. Head width, 42 units; pronotal width, 58 units. Antennal proportions about as in male. Apical segment of abdomen broadly rounded above; beneath laterally compressed so that its hind margin as seen from the rear is broadly V-shaped. Ovipositor and genital segments visible, though retracted within the apical segments of venter. **Length,** 7.7-7.9 mm. **Width,** 2.38 mm.

Holotype, male, and **allotype,** female, Kawishiwi River, Minnesota, August 28, 1919, H. H. Knight (in author's collection). **Para-**

types, 16 males and females, Kawishiwi River, Minn., Aug. 26-30, 1919; Polk Co., Minn., Aug. 11, 1936, R. H. Daggy; Mille Lacs Co., Minn., June 19, 1936 W. A. Riley; Carlton Co., Minn., May 19, 1936, P. M. Schroeder; Itasca Park, Minn., Aug. 11, 1937, R. H. Beamer; and Cloquet, Minn., Sept. 8, 1936, H. R. Dodge (in collections of H. H. Knight, University of Minn., University of Kansas; U. S. National Museum, and author).

The darker markings are variable, as in other Rhopalini, and in some of the specimens the connexivum is distinctly maculate. In all the individuals at hand there is a more or less uniform pale spot in the form of an inverted Y, extending back on the next to last dorsal segment. The apical segment is pale with an elongate oval black spot on its disc. The species is named in honor of Dr. Harry Knight and has stood in my collection under the name **knighti** for the past ten years.

Arhyssus barberi, sp nov.

Related to A. **scutatus** (Stal), and heretofore confused with it in most collections, but recognized by its much larger size, more flattened vertex, different body proportions, the nature of vestiture and sculpture, and the characters of the scutellum and genitalia.

Elongate oval, the sides more or less parallel. Yellowish testaceous with brown to black markings. Head one-fifth broader than long (42:35), rugosely punctate above; the vertex relatively flat, its width (26) slightly less than distance from ocelli to apex of tylus as seen from above. Antennae moderately long, segment I distinctly swollen before the middle, barely attaining apex of head; proportion of segments, 10:30:26:31. Antenniferous tubercules, as seen from the side, stout, not produced. Lorum faintly widened anteriorly, the apex truncate. Bucculae high, tapering, embracing slightly more than half of first rostral segment. Rostrum barely attaining posterior coxae, segment I just reaching base of head; proportions, 21:22:14:18. Pronotum much broader than long (60:35); gradually tapering anteriorly, the sides very feebly sinuate behind the cicatrices, the disc uniformly punctate, with a more or less distinct median longitudinal line which is raised and prominent along the interlobe area. Scutellum with distinct pale median line, as broad as long, the sides concavely sinuate slightly behind middle, the apical part pale, broadly rounded, almost flat across tip. Hemelytra with reddish-brown dots on the nervures. Legs fairly stout and hairy, distinctly speckled. Ostiolor opening large, placed low between intermediate and posterior coxae. Metapleuron broad, the posterior area not coarsely punctate, its hind margin not strongly oblique. Venter pale, in darker specimens with an obsolete broad lateral stripe. Genital capsule of male with the dorso-lateral edge in-

flexed, the median ventral portion broadly produced between the claspers, the latter slender, their tips curved. Lateral plate of female genitalia obliquely produced backwards as a flattened digitiform process. **Length:** male, 7.5-8.0 mm.; female, 8.0-8.5. **Width** of pronotum: male, 2.5; female, 2.9 mm.

Holotype, male, and **allotype,** female, Moscow mountain, Idaho, July 20, 1938, H. M. Harris (in my collection). **Paratypes,** many males and females, Moscow mountain, Idaho, various dates; Troy, Idaho, Aug., 1938, H. M. Harris; Kendrick, Idaho, August, 1938, H. M. H.; Parma, Idaho, Sept. 10, 1926, C. W. Wakeland; (in collections of U. S. National Museum; Univ. of Kansas; Ohio State Univ.; Calif. Acad. Sci.; Oregon State College, Univ. of Idaho; and Iowa State College.) Specimens also are at hand from Corvallis, Ten Mile, Dilley, Hood River, and Lane County, Oregon; Richfield, Utah; Lucerne, Fresno, Redding, and Giant Forest, California; and Yakima, Pullman, Dayton, Tampico, and Mt. Adams, Washington.

As stated above this species has heretofore been confused with **scutatus** (Stal.) and stands in many collections under that name. The basic color pattern of the abdominal disc is that pictured by Hambleton for **scutatus.**

It is named for Mr. Harry G. Barber who has had an abiding interest in this difficult group of bugs and who has helped me in many ways in my studies of them.

Arhyssus usingeri, sp. nov.

Recognizable by its small size, slender form, long head, long rostrum and the characters of scutellum, metapleuron, and genitalia.

Color yellowish to reddish testaceous, speckled with brown, the abdomen above pictured with black. Head only slightly broader than long (24:22), punctate and pubescent, the vertex (14) arched. Antennae short, segment I distinctly not attaining apex of head, IV stoutest, not quite four times as long as thick; proportion of segments, 7:10:10:15. Rostrum long, extending on second segment of venter, segment I about attaining base of head; proportion of segments, 13:15:11:11. Buccuale low, tapering, reaching to about middle of head. Pronotum rather thickly and uniformly punctate, with fine, semi-erect pale pubescence, broader than long (30:18), the sides nearly straight. Scutellum small, the apex pointed. Veins of hemelytra speckled, with pale semi-erect pubescence. Membrane about attaining apex of abdomen. Legs short, pubescent and setose. Sternum darkened, with longitudinal sulcus. Metapleuron bipartite, the hind margin of posterior portion strongly concave. Venter feebly sulcate at base for reception of rostral tip, the hind margin of last segment as seen from the side strongly concavely sinuate in male, feebly so in female. Last dorsal segment broadly rounded in male,

more narrowly rounded in female, ciliate. Male clasper strap-like, recurved, pointed; genital capsule with a knob on upper lateral edge. **Length:** 4.0-4.7 mm. **Width:** 1:25-1.50 mm.

Holotype, male, and **allotype,** female, Pine Canyon, Mt. Diablo, California, May 23, 1937, on **Salvia mellifera,** R. L. Usinger (in Calif. Acad. Sci.). **Paratypes,** males and females, taken with types, and at Niles Canyon, Alameda Co., Calif., May 26, 1928, R. L. Usinger; Salinas, Calif., Apr. 26, 1908, E. D. Ball; Claremont, Calif., July 29, 1935, R. H. Beamer; San Bernardino Co., Calif., May 1, 1923, W. Benedict; San Jacincto Mts., Calif., June 30, 1933, R. H. Beamer (in collections of Calif. Acad. Sci., U. S. Natl. Museum, Univ. of Kansas, R. L. Usinger, and author).

The Claremount specimens are uniformly paler and larger than the Mt. Diablo examples. The species is named for Dr. R. L. Usinger, who recognized the species as new and sent me a long series now some three years ago.

Arhyssus crassus, sp. nov.

Closely allied to A. **barberi,** sp. nov., but recognized by its more obovate form, slightly smaller size, more orange-yellow color, the coarser punctures and vestiture, and the characters of head, scutellum, and genitalia.

Head longer than broad (40:34), more strongly setose and more coarsely punctate than in A. **barberi,** the vertex (27) more definitely arched. Eyes smaller than in **barberi.** First antennal slightly swollen toward middle, just attaining apex of head; antennal proportions, 10:25:20:25. Antenniferous tubercules as viewed from above slightly more produced than in **barberi.** Rostrum attaining hind coxae; proportion of segments, (20:22:17:21). Pronotum much broader than long (60:35), more corasely and irregularly punctate than in **barberi.** Scutellum usually somewhat more broadly rounded apically and much more distinctly cupped or excavated on apical portion than in **barberi.** Abdomen widened to beyond middle. Venter usually with broad sub-lateral dark stripe. Genital capsule of male about as in related species, the produced median basal portion narrower than in **barberi,** the claspers more slender, their apices less recurved. Lateral plates of female genitalia with the produced part shorter. **Length:** male, 7.2-7.4 mm. female, 7.4-8.0 mm. **Width:** pronotum, 2.3-2.7 mm.; abdomen, 2.7-3.7 mm.

Holotype, male, and **allotype** female, Troy, Idaho, July 16, 1938, H. M. Harris (author's collection). **Paratypes,** males and females, Troy, Idaho; Moscow Mt., Idaho, July 20, 1933, H. M. Harris; Lenore, Idaho, May, 1938; Parma, Idaho, Aug. 21, 1925; Lewiston, Idaho, Apr. 28, 1936, V. E. Nygren; Moscow, Idaho, Oct. 3, 1931, Paul Rice;

Grangeville, Idaho, June 20, 1933, Harris and Shull; Pullman, Washington; Puyallup, Washington; Yakima Washington; Blewett, Washington, May 24, 1931, F. P. Dean; Wawawai, Washington, May 20, 1911; Biggs, Oregon, July 16, 1931, R. H. Beamer; Weston, Oregon, April 28, 1938, Schuh and Gray; Lake View, Oregon, July 27, 1930, H. A. Scullen; Corvallis, Oregon, Mar. 11 , 1935, Hood River, Oregon, July 17, 1931; Haines, Oregon, July 10, 1931, J. Nottingham; Palo Alto, California, Apr. 6, 1892; Taft, Calif., Aug. 5, 1937; Cuyama Ranch, Calif., July 25, 1935, R. H. Beamer; Claremont, Calif., Baker; Provo Bench, Utah, D. E. Beck; National Park, Wyoming, Oct., 1891 (in collections of U. S. Nat. Museum, Univ. Kansas, Oregon State College, Washington State College, Brigham Young Univ., University of Idaho, and Calif. Acad. Sci.).

This species has been much confused with **Arhyssus scutatus** (Stal) and **A. barberi** n. sp. It is distinctly larger than the former. Among the many slight differences that serve to distinguish it from **barberi** are its less strongly swollen first antennal segment, and the more prominent punctures on apical third of scutellum. The apical antennal segment is not so stout and is more gradually enlarged from the base.

Arhyssus brevipilis, sp. nov.

Belonging to the **scutatus-indentatus** group of species, but at once recognizable by the short, appressed pubescence.

Head, broader than long (34:27), coarsely punctate, with a few scattered setae toward apex, elsewhere with short, appressed silvery pubescence. Antennae moderately long, segment I stouter than in **indentatus** (Hambleton), slightly surpassing apex of head, the hairs of segments II and III not longer than diameter of segment; proportion of segments 11:20:18:23. Bucculae high, extending to apical fourth of first rostral segment. Rostrum reaching beyond middle of metasternum, segment I not quite attaining base of head; proportion of segments, 17:15:11:14. Pronotum broader than long (45:27), coarsely punctate, with short appressed pubescence, not setose, the impressed smooth lines in front rather distinct, the disc noticeably transversely constricted in front of middle. Scutellum not so broadly rounded apically as in **indentatus**; the lateral edges raised, constricted just behind middle, the disc of apical part concave. Hemelytra with nervures speckled with brown, the clothing hairs very short and semi-recumbent; membrane just attaining apex of abdomen. Body beneath with clothing hairs shorter and of different character than in **indentatus**. Metapleuron with hind margin a little more concavely sinuate than in related species. Legs speckled, distinctly less setose than in **indentatus**. Clasper slender. **Length**: 5.5-5.9 mm. **Width** of pronotum: 1.7-1.9.

Female: Slightly broader than male, the scutellum more broadly rounded. Rostrum just attaining base of venter, first segment almost reaching base of head. Apical segments of abdomen more sharply rounded than in male, the upper margin ciliate. Lateral plate of genital segment produced apically. **Length:** 5.7-6.1 mm. **Width:** 1.9-2.1 mm.

Holotype, male and **allotype,** female, Moscow Mountain, Idaho, July 20, 1938, H. M. Harris (in my collection). **Paratypes,** males and females, Moscow Mountain, Idaho; Kendrick, Idaho, July 13, 1938, H. M. Harris; Kootenai, Idaho, July 8, 1938, H. M. H.; Yakima, Washington, June 10, 1930, A. R. Rolfs; Signal Pk., Washington, July 4, 1930, A. R. Rolfs; Parkdale, Oregon, June 23, 1938, K. Gray.

Some of the specimens have shorter antennal and rostral segments and stouter first antennal segment than the type.

ZINC OXIDE: A NEW LARVICIDE FOR USE IN THE MEDICATION OF CATTLE FOR THE CONTROL OF HORN FLIES

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The successful internal medication of cattle for the purpose of rendering their droppings unsuitable for the development of larvae of the horn fly, **Haematobia irritans** (L.), was visualized by Gallagher (1928) and later realized by Knipling (1938). Subsequent experimentation by the writer (1939, 1940) involved 68 tests with 29 chemicals. Some of these chemicals proved effective, but they were either too expensive or had some undesirable features that made them unfit for general use. The most effective chemical tested was rotenone, fed daily at the rate of 0.3 gram per 100 pounds body weigth of the animal. Another chemical, phenothiazine, was effective in daily doses of 1 gram per hundredweight, but it had the undesirable effect of imparting a reddish tinge to the milk of cows.

Experiments were continued in 1940 and 1941 in an effort to find a chemical that would be toxic to larvae of the horn fly, harmless to cattle, inexpensive, and commonly available. Zinc oxide appears to meet these requirements.

Zinc oxide (ZnO) is a very fine, odorless, tasteless, amorphous, white powder. The following is quoted from Wood and LaWall (1937):

> "Zinc oxide has been used as an antispasmodic in chorea, epilepsy and whooping cough . . . It is also sometimes employed for its astringent and sedative properties in diarrhea.

Its most important use, however, is as an application to excoriated surfaces and in various skin diseases. It owes its popularity to a combination of four qualities: it is nontoxic, protective, mildly astringent and probably antiseptic."

Procedure

The experimental cattle were confined in a screened building and fed a ration of bran and prairie hay. After the cattle had been given dry feed for 2 days they were fed zinc oxide (U.S.P.) mixed with moist bran. A sample of the dropping collected within 1 hour prior to medication was used as a check. The animals were medicated at 4 p. m., and droppings were collected at approximately 8 a. m. and 4 p. m. each day thereafter for as many days as the test was in progress. A sample of approximately 500 grams of the droppings from each collection was placed on 800 grams of moist sand in a pan and infested with 100 horn fly eggs. Each sample was kept in an individual 18-mesh screen cage in the insectary, and the emergence of flies therefrom was recorded.

Results

Zinc oxide in the droppings had no ovicidal qualities, as indicated by the hatch of 11,120 of the 11,700 horn fly eggs used in these tests, an average hatch of 95.04 per cent.

The dose of zinc oxide for six animals tested ranged from 1 gram to 3 grams per 100 pounds body weight of the animal. The minimum dose necessary to prevent development of horn fly larvae in the droppings was 1.5 grams per hundredweight. Three doses of 10.5 grams each (1.5 grams per hundredweight) administered at daily intervals to a 700-pound steer were effective for 3 days, beginning about 20 hours after the administration of the first dose, and 75 per cent effective on the fourth day. Twenty doses of 4.5 grams each (1.5 grams per hundredweight) administered at daily intervals to a 300-pound heifer were effective for 20 days, beginning about 20 hours after the administration of the first dose, and showed some larvicidal effect for 2 days after the last dose was administered. It is evident from these two tests that a dose of 1.5 grams of zinc oxide per hundredweight was an effective larvicide for approximately 24 hours.

The test animals never hesitated in eating the bran containing zinc oxide, and they remained in good condition throughout the tests.

Treatment of Droppings

To determine the quantity of zinc oxide necessary to render cattle droppings toxic to horn fly larvae, when the chemical was mixed directly with the droppings, a number of tests were made in

which from 0.0003 gram to 1.0 gram of zinc oxide to 100 grams of droppings was used. The method was to mix 800 grams of droppings in an electric mixer for 15 minutes. From this original mixture 400 grams were taken for use as a check sample. To the remaining 400 grams of dropping the zinc oxide and an additional 400 grams of dropping were added, and the mass stirred in the electric mixer for another 15 minutes. This procedure of mixing and halving the samples, without the addition of more zinc oxide, was repeated as necessary. These tests were made in two series, one series containing from 0.015 to 1.0 gram of zinc oxide to 100 grams of droppings and the other containing from 0.0003 gram to 0.08 gram of zinc oxide per 100 grams of droppings. Each sample dropping was infested with 100 horn fly eggs and placed on moist sand in an individual screen cage for observation on adult emergence. The average hatch of eggs used in these tests was 96.4 per cent. The minimum lethal concentration of zinc oxide was 0.01 gram per 100 grams of droppings. Ten tests with 0.01 gram or more per 100 grams of dropping gave 100 per cent control. Some larvae developed in each of six samples of droppings containing zinc oxide in the amount of 0.005 gram or less per 100 grams of droppings. This minimum lethal concentration of 0.01 gram of zinc oxide per 100 grams of droppings is equivalent to 0.2 pound of zinc oxide per ton of droppings.

Summary

Experiments were conducted to determine the value of zinc oxide in preventing the development of larvae of the horn fly, **Haematobia irritans** (L.), in cattle droppings. When various quantities of the chemical mixed with bran were fed to cattle, the minimum effective dose was 1.5 grams per 100 pounds weight of the animal. This dose rendered the droppings unfavorable for the development of horn fly larvae for 24 hours, beginning 20 hours after administration. When zinc oxide was mixed directly with the droppings, the minimum lethal dose was 0.01 gram for each 100 grams of droppings.

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DAMAGE TO KERNELS OF WHEAT BY HARPALUS AMPUTATUS SAY,* IN WESTERN KANSAS

ROBERT E. BUGBEE[1]

On October 10, 1941, Mr. A. R. Hanks of Dighton, Kansas sent to the Zoology Department of Fort Hays Kansas State College several live specimens of a ground beetle which proved to be **Harpalus amputatus** Say. Accompanying the beetles were several kernels of wheat which showed evidence of having been gnawed or chewed. More than half of the kernel had been eaten in some cases. According to Mr. Hanks, it was the work of the beetle mentioned above. Live specimens kept in captivity readily gnawed kernels of wheat. The sender stated that the beetles were doing considerable damage to shallowly-sown wheat in the neighborhood of Dighton and seemed to be present in enormous numbers. He estimated that about fourteen years ago a similar attack, by what he thought was the same species, occurred.

On checking with Mr. R. T. Cotton of the Bureau of Entomology and Plant Quarantine, stationed at Manhattan, Kansas on possible previous records of similar damage by **H. amputatus**, information by letter stated that he did not know of any previous records of phytophagy for this species in Kansas. The species is mentioned, however, several times in "Lists of Coleoptera," for Kansas by Popenoe (1877), Colorado (Snow, 1877) and New Mexico (Snow, 1881). Thus it has been known for more than 65 years but this appears to be the first record of a phytophagus habit in Kansas.

Phytophagy in other members of the family, including the genus **Harpalus**, has been recorded by several authors. Thus by letter Mr. Cazier states, "many of the members of this genus feed on seeds of wild plants." Blatchley in "Coleoptera of Indiana" (1910) lists **Harpalus caliginosus** Fab. and **H. pennsylvanicus** Dej. as feeding on seeds of ragweed in addition to caterpillars and other insect larvae.

*Kindly identified by Mr. Mont A. Cazier of the American Museum of Natural History. New York.

[1]Contribution No. 43 from the Zoology Department of Fort Hays Kansas State College, Hays, Kansas.

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